

Extent of Effects and Practices on Climate Risk Management of Manufacturing Firms in the Province of Batangas

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Abstract— The study aimed to identify the manufacturing companies' risk management practices towards climate change. Towards this goal, the study investigated firstly the areas of business affected by climate change and secondly, the effectiveness of their climate change risk management practices. The study looked into the significant difference on how the respondents assess the effects of climate change on their business as well as the effectiveness of climate risk management practices when compared according to their profile variables. Descriptive survey method was employed in the conduct of the study. A validated questionnaire was used to gather the needed data among 174 manufacturing companies in Batangas Province. The data were analysed with the use of frequency count, percentage and weighted mean, as well as analysis of variance (ANOVA) for the significant difference of the means. It was found that climate change has a moderate effect in the areas of production and operation, finance and accounting, and marketing. Among the areas of climate change risk management practices, only those that involve managing the risks were regarded as effective, while the rest were considered moderately effective. It is suggested that the manufacturing companies create sustainable partnerships among other companies that have successfully implemented climate change risk management initiatives to minimize the impacts brought about by the climate change.

Keywords— Climate change, manufacturing companies, risk management, adaptation, operations.

I. INTRODUCTION

Many businesses and entrepreneurs are seeing opportunities in the changes that are happening in the global climatic systems. However, the wide spread chaos and the damages that the impacts of climate change had brought both on the life and properties as well as on the reservoir of resources cannot be denied. Nations and countries are cooperating with each other to find solutions to the problems brought about by this situation hoping that they could find adaptation solutions if mitigation strategies are no longer feasible.

In the Philippines, the effects of a changing climate are evident. The occurrence of flash floods due to heavy rains, the landslides, the visible rise in the sea level and the warming of oceans and other bodies of water are evident indicators that the country is severely affected by the changes in the climatic systems. The increase in the cases

of climate related illnesses are also on the rise such as the rise of vector borne diseases (Castello A., 2009). The government is spending so much to rehabilitate regions, provinces, cities and municipalities from the said effects which are actually getting worse as time goes on. Even though the government had actually concretized the legislation of the Climate Change Act, coupled with other legislations that support the said law, the implementation is still in the slow phase. The mitigation and adaptation actions have not taken its full gear and developments on the policies and its outcomes were very minimal. The participation and commitment of different sectors of the society are not solid, thus producing negligible results.

Among the different sectors of the society, perhaps one of the most important and highly affected by the impacts of climate change is the business sector. They command a large proportion of the resources and are considered as the primary contributor to the causes of climate change. Therefore, their commitment to the efforts of mitigating and adapting to the climate change is very important. Business sector's participation and commitment could definitely boost any national and global action towards adapting and mitigating the effects of climatic changes. For the business sector, climate change adaptation means managing the risks and discovering new opportunities to maintain a competitive edge.

In a recent report from Global Climate Risk Index (Kreft, 2015), it ranked Philippines as the number one most affected country by climate change using 2013 data. It identified the five different risk factors the country is most vulnerable to, and these are: a rise in sea levels; extreme rainfall events; extreme heating events; increased ocean temperatures; and a disturbed water budget. Tropical storms, which hit the country on average eight to nine times a year and are expected to increase in severity because of climate change, exacerbate these risks. Given the Philippines' vast shorelines and built-in geographical susceptibility, any one of these risks could be disastrous.

Batangas Province, located on the southwestern part of Luzon in the CALABARZON region, is considered as one of the most developed provinces in the Philippines. Batangas offers an alternative transport hub closest to Manila. One climate vulnerability of Batangas Province stems from the increased flooding that seems to be hampering access through the major highways during periods of heavy rainfall (Business Risk Assessment & the

Management of Climate Impacts, 2016).

This study is specifically done in order to evaluate the risk management practices of the business sector, specifically the manufacturing industry in Batangas Province towards the impacts of climate change. This study will primarily endeavor to determine the current actions that manufacturing companies are taking in order to manage the risks brought about by the climate change. This study is done primarily to propose guidelines for implementation that could help manufacturing sector in adopting of mitigating the impacts brought about by the climate change.

II. STATEMENT OF THE PROBLEM

The study aimed to assess the climate risk management practices of manufacturing companies in Batangas Province.

Specifically, the study sought answers to the following questions:

1. What is the profile of the study in terms of:
 - 1.1 Employee respondents
 - 1.1.1 Job managerial level;
 - 1.1.2 Number of years involved in climate management; and
 - 1.1.3 Number of trainings attended related to climate risk management?
 - 1.2 Company respondents
 - 1.2.1 Form of business organization;
 - 1.2.2 Type of product manufactured;
 - 1.2.3 Capitalization;
 - 1.2.4 Number of years in operation; and
 - 1.2.5 Number of years climate risk management has been adopted?
2. How may the extent of effects of the climate change to the manufacturing companies be assessed in terms of:
 - 2.1 Production and operation;
 - 2.2 Finance and accounting; and
 - 2.3 Marketing?
3. How may the Climate Change Risks Encountered by the Manufacturing Firms be assessed by the manufacturing firms?

4. How may the effectiveness of climate risk management practices of the manufacturing companies be assessed in terms of:
 - 4.1 Building awareness;
 - 4.2 Assessment of vulnerability;
 - 4.3 Management of risks; and
 - 4.4 Review and feedback?
5. What are the factors affecting the implementations of the Climate Risk Management Practices among the manufacturing firms in Batangas Province?
6. What are the level of Preparedness of the Manufacturing Firms in Addressing the Climate Change Risks
7. Is there significant difference in the assessment of the extent of effects of climate change to the manufacturing business when grouped according to profile variables?
8. Is there significant difference in the assessment on the effectiveness of climate risk management practices of the manufacturing companies when grouped according to profile variables?
9. Based on the results of the study, what guidelines for implementation of climate risk management practices can be proposed?

III. METHODOLOGY

The study utilized the descriptive design and involved 174 manufacturing companies operating in Batangas Province which were chosen through multi-stage random sampling. A validated questionnaire used as the primary data gathering tool for the study. Aside from the questionnaire, the researchers also conducted interviews to gather more insights from the respondents. Descriptive statistics was used as well analysis of variance (ANOVA) to interpret the gathered data.

IV. RESULTS AND DISCUSSIONS

The succeeding sections presents the result of this study.

1. Profile of the Respondents

1.1. Employee Respondents

Table.1: Profile of the Employee Respondents

| Job Managerial Level | F | % |
|---|------------|---------------|
| Top Management | 54 | 27.98 |
| Middle Management | 81 | 41.97 |
| Supervisor | 36 | 18.65 |
| Others | 22 | 11.40 |
| Total | 193 | 100.00 |
| Number of years involved in Climate Risk Management | F | % |
| 5 years and less | 118 | 61.14 |
| 6 - 10 years | 57 | 29.53 |
| 11 - 15 years | 8 | 4.15 |
| 16 - 20 years | 4 | 2.07 |
| More than 20 years | 5 | 2.59 |
| No response | 1 | 0.52 |
| Total | 193 | 100.00 |
| Number of trainings related to Climate Risk Management | F | % |
| 5 and below | 145 | 75.13 |
| 6 to 10 | 35 | 18.13 |
| 11 to 15 | 4 | 2.07 |

| | | |
|--------------|------------|---------------|
| More than 20 | 3 | 1.55 |
| No response | 6 | 3.11 |
| Total | 193 | 100.00 |

Most of the respondents equivalent to 41.97% belong to the middle management, while 61.14% have been involved in climate change risk management for less than 5 years and 75.13% have attended less than 5 trainings related to climate change risk management.

1.2. Company Respondents

Table.2: Profile of the Company Respondents

| Form of Business | F | % |
|---|------------|---------------|
| Corporation | 114 | 65.52 |
| Partnership | 6 | 3.45 |
| Single Proprietorship | 46 | 26.44 |
| Cooperative | 8 | 4.60 |
| Total | 174 | 100.00 |
| Type of Product Manufactured | F | % |
| Non-metallic products | 19 | 10.92 |
| Automobile & auto parts | 1 | 0.57 |
| Textile, wearing apparel | 34 | 19.54 |
| Wood & wood products | 4 | 2.30 |
| Basic metals | 9 | 5.17 |
| Chemicals & chemical products | 12 | 6.90 |
| Animal feeds | 45 | 25.86 |
| Paper, paper products | 1 | 0.57 |
| Electrical % electronics | 7 | 4.02 |
| Food, beverages % tobacco | 33 | 18.97 |
| Others | 9 | 5.17 |
| Total | 174 | 100 |
| Capitalization | F | % |
| Less than P3 million | 54 | 31.03 |
| P3 million to P15 million | 56 | 32.18 |
| P16 million to P100 million | 38 | 21.84 |
| More than P100 million | 25 | 14.37 |
| No response | 1 | 0.57 |
| Total | 174 | 100.00 |
| Number of years in Operation | F | % |
| 5 years and below | 26 | 14.94 |
| 6 - 10 years | 37 | 21.26 |
| 11 - 20 years | 57 | 32.76 |
| More than 20 years | 54 | 31.03 |
| Total | 174 | 100.00 |
| Number of years Climate Risk Management Practices were Adopted | F | % |
| Less than 5 years | 108 | 62.07 |
| 5 to 10 years | 25 | 14.37 |
| 11 to 15 years | 25 | 14.37 |
| 16 to 20 years | 8 | 4.60 |
| More than 20 years | 8 | 4.60 |
| Total | 174 | 100.00 |

Majority of the companies were organized as corporation equivalent to 65.52%, while 25.86% are engaged in the manufacture of animal feeds, 32.18% have capitalization of P3 million to P15 million. Furthermore, fifty seven companies equivalent to 32.76% have been operating for 11 to 20 years now and 62.07% have less than 5 years of adopting climate change risk management practices.

2. Areas of Business Affected by Climate Change.

Table.3: Areas of Business Affected by Climate Change

| Areas of Business Affected by Climate Change | WM | VI |
|---|-----------|-----------|
|---|-----------|-----------|

| Production and Operations | | |
|---|------|-----------------|
| Energy fluctuations/blackouts for companies | 4.14 | Moderate Effect |
| Resource availability such as water and raw materials | 3.80 | Moderate Effect |
| Damage on company's plant, fixed assets and infrastructure | 3.76 | Moderate Effect |
| Supply chain flow | 3.33 | Less Effect |
| Availability of workforce especially during critical periods | 3.19 | Less Effect |
| Overall Weighted Mean | 3.64 | Moderate Effect |
| Finance and Accounting | | |
| Creation of new investment opportunities | 3.57 | Moderate Effect |
| Insurance costs of fixed assets | 3.46 | Less Effect |
| Cost of capital and operational expenditure | 3.84 | Moderate Effect |
| Liability and litigation costs | 2.48 | Least Effect |
| Cost of complying with present and future regulations related to climate change | 3.80 | Moderate Effect |
| Overall Weighted Mean | 3.43 | Less Effect |
| Marketing | | |
| Volatility of commodity prices | 3.80 | Moderate Effect |
| Changing tastes, lifestyles and customer behaviour | 3.66 | Moderate Effect |
| Transportation and delivery of products to intended markets | 3.54 | Moderate Effect |
| Greater demand for more innovative products | 3.70 | Moderate Effect |
| Delivery of marketing communications to potential and existing consumers | 2.96 | Less Effect |
| Overall Weighted Mean | 3.53 | Moderate Effect |

Table 3 revealed that climate change has a moderate effect on the areas of business such as production and operations, finance and accounting, and marketing.

In the area of production and operation, it was revealed that climate change has a moderate effect in terms of energy fluctuation or blackouts, resource availability such as water and raw materials, and on damage on company's plant, fixed assets and infrastructure. This runs parallel to the study of (Cruz, Harasawa, Lal, Wu, & Anokhin, 2007), which found that major power outages happened because of very high summer temperatures. However, it was assessed that climate change has a less effect on the company's supply chain flow and on the availability of workforce especially during critical periods.

In the area of finance and accounting, climate change was assessed to have a moderate effect on the creation of new investment opportunities, cost of capital and operational expenditure, and on the cost of complying with present and future regulations related to climate change. These findings are synonymous with those of (Galbreath, 2012) which stated that costs on energy, raw materials,

3. Climate Change Risks Encountered by the Manufacturing Firms

Table.4: Climate Change Risks Encountered by the Manufacturing Firms

| Physical Impacts | Weighted Mean | Verbal Interpretation |
|---|---------------|-----------------------|
| Increased frequency of extreme weather events | 4.04 | Moderate Risk |
| Flooding or sea level rise | 3.13 | Less Risk |
| Drought or water scarcity | 3.20 | Less Risk |
| Change in temperature | 3.85 | Moderate Risk |
| Poor availability and quality of water | 3.14 | Less Risk |
| Coastal erosion | 2.22 | Least Risk |
| Induced changes in natural resources | 3.34 | Less Risk |
| Changing landscapes | 3.06 | Less Risk |
| Typhoons | 4.50 | High Risk |
| Overall mean | 3.25 | Less Risk |

capital expenditures and even in insurance premiums are expected to increase as a result of adapting to the impacts of climate change.

In the area of marketing, climate change was revealed to have a moderate effect in terms of volatility of commodity prices, changing tastes, lifestyles and customer behavior, transportation and delivery of products to intended markets, and greater demand for more innovative products. Owing to the nature of their operation, manufacturing companies may have firmly set their marketing designs and infrastructure, which cannot be easily changed as a response to extreme weather events brought about by climate change. Their systems and processes may be locked in for a considerable long period of time, which renders them vulnerable to sudden changes in the marketing environment as a result of the changing climate. In terms of customer loyalty as a major element of value, these findings are corollary to that findings of (Schuchard, 2010) which stated that consumer tastes and preferences may vary with increased desire for climate-compatible goods.

Table 4 shows that with regard to the physical impacts of Climate Change encountered by the manufacturing firms, it is shown that typhoon was identified as high risk with weighted mean of 4.50. Increased frequency of extreme weather events and change in temperature was identified to have moderate risk with weighted means of 4.04 and 3.85 respectively. The other physical impacts of climate change such as induced changes in the natural resources, drought or water scarcity, poor availability and quality of water, flooding and sea level rise, changing landscapes, all got a verbal interpretation of less risk with weighted means of 3.34, 3.20, 3.14, 3.13 and 3.06 respectively. Lastly the coastal erosion as physical impact of climate change encountered by the manufacturing firms

was identified to have least risk with weighted mean of 2.22. The climate change risk encountered by the manufacturing firms earned the overall weighted mean of 3.25 with verbal interpretation of less risk.

It can be gleaned from the data on table 5 that the manufacturing firm perceived typhoon to have a high risk when it comes to the physical impact of climate change that are encountered by the manufacturing firms. This can be attributed to the fact that the locations of the manufacturing firms are commonly affected by the typhoons that visit the area. The increasing strength of the typhoons increase the severity of impacts that bring about destructions on the physical infrastructure and in the operations of the manufacturing firms.

4. Effectiveness of Climate Change Risk Management Practices

Table.5: Effectiveness of Climate Change Risk Management Practices

| Areas | WM | VI |
|--------------------------|-------------|-----------------------------|
| Building Awareness | 3.43 | Moderately effective |
| Vulnerability Assessment | 3.43 | Moderately effective |
| Risk Management | 3.82 | Effective |
| Feedback and Review | 3.38 | Moderately effective |
| Overall | 3.52 | Moderately effective |

The study revealed that among the practices of a climate change risk management program, those that are related to risk management were regarded as effective while those that relate to building awareness, vulnerability assessment, and review and feedback were considered as moderately effective.

It can be viewed that the respondents assessed most of their climate change risk management practices as moderately effective which include the areas of building awareness, vulnerability assessment and feedback and review, with weighted means of 3.43, 3.43 and 3.38 respectively. This runs parallel with the report (Climate Change Impacts and Risk Management: A Guide for Business and Government, 2006) which emphasized that the communication and consultation process will contribute towards the long term development of risk management and help to establish a foundation for its continuing maintenance.

This is in line with the study of (Moran, Cohen, Swem, & Shaustyuk, 2005) Moran which stated that the companies are more vulnerable if they have more long-term capital assets, a more elaborate supply chain, and climate-sensitive resources.

On the other hand, the practices related to risk management were evaluated as effective with weighted mean of 3.82. This aspect is where the policies, programs, strategies and techniques intended to manage the risks brought about by climate change are implemented.

5. Factors Affecting the Implementations of the Climate Risk Management Practices

Table 6 shows the factors that affect the implementation of the climate risk management practices as perceived by the manufacturing firms

Table.6: Factors Affecting Implementation of Climate Change Risk Management Practices

| Barriers to Implementation | Mean | Verbal Interpretation |
|--|-------------|-----------------------|
| Ambiguous language and terminology | 3.91 | Strong Effect |
| Lack of understanding of the costs of inaction | 4.11 | Strong Effect |
| Insufficient organizational commitment | 4.16 | Strong Effect |
| Negative framing of the climate change impacts | 3.88 | Strong Effect |
| Lack of internal buy-in | 3.80 | Strong Effect |
| Unclear performance indicators | 3.97 | Strong Effect |
| Insufficient expertise | 4.15 | Strong Effect |
| Unclear signals from government and stakeholders | 4.18 | Strong Effect |
| Lack of strong regulation | 4.50 | Very Strong Effect |
| Overall mean | 4.02 | Strong Effect |

Legend: VSE = Very Strong Effect, SE = Strong Effect, ME = Moderate Effect, LE = Less Effect, NE = No Effect

Table 6 shows that in terms of the factors that affect the implementation of the climate risk management practices, the respondents from the manufacturing firms disclosed that lack of strong regulation, has a very strong effect with a weighted mean of 4.50, the factors such as unclear signals from the government and stake holders, insufficient expertise, insufficient organizational commitment, lack of understanding of the cost of inaction, unclear performance indicators, ambiguous language and terminology, negative framing of the climate change impacts and lack of internal buy-in all have a strong effect on the implementation of the climate risk management practices with weighted means of 4.18, 4.16, 4.5, 4.11, 3.97, 3.91, 3.88 and 3.80 respectively.

It can be seen from the data on the table 6 that the manufacturing firms perceived that lack of strong regulation is a factor that have a very strong effect on the implementation of the climate risk management practices. This response can be explained by the fact that it is very common in the Philippines that if there is no strong regulation, then the business will not act. This is because

Table.7: Level of Preparedness of the Manufacturing Firms in Addressing the Climate Change Risks

| Level of Preparedness | Mean | Verbal Interpretation |
|--|------|-----------------------|
| What is the level of preparedness of your organization in managing climate change impacts? | 2.26 | Somewhat Prepared |

It can be gathered that when it comes to the level of preparedness of the manufacturing organizations in managing the climate change impacts, the manufacturing firms revealed that they are somewhat prepared which earned the weighted mean of 2.26.

It can be gleaned from the response of the respondents from the manufacturing firms that they “somewhat prepared”. The response of the respondents on the level of preparedness is indicative that there is some uncertainty on their part on the real status in terms of managing the current and the future impacts of climate change. Some

7.1. Form of Business

Table.5: Significant Differences on the Extent of Effects of Climate Change to the Manufacturing Companies in Terms of Form of Business

| Areas | F value | P-value | Decision |
|---------------------------------|---------|---------|-------------------|
| Production and Operations | 0.762 | 0.517 | Fail to reject Ho |
| Finance and Accounting | 1.842 | 0.141 | Fail to reject Ho |
| Marketing of Goods and Services | 1.470 | 0.224 | Fail to reject Ho |

Since the computed F-value of 0.762 which yields a p-value of 0.517 that is greater than the critical value of 0.05 thus, there is no significant difference on the assessment of the respondents regarding the operation and production as an area of the business affected by the climate change when they are grouped according to form of ownership as company profile. Moreover, since the computed F-value of 1.842 which yields a p-value of 0.141 which in turn is less than the critical value of 0.05, thus there is no significant difference on the assessment of the

7.2. Type of Product being Manufactured.

most of the business in the Philippines still considers actions towards the mitigation of the impact of climate change as an expense and not as an investment. It must also be noted that the other factors were considered by the manufacturing firms to have a strong effect in the implementation of the climate risk management practices. These factors include unclear signals from the government and stake holders, insufficient expertise, insufficient organizational commitment, lack of understanding of the cost of inaction, unclear performance indicators, ambiguous language and terminology, negative framing of the climate change impacts and lack of internal buy-in. This indicates that the manufacturing firms are actually recognizing the factors that hinders them from implementing suitable actions towards addressing the impacts of climate change risks that they encounter in the present.

6. Level of Preparedness of the Manufacturing Firms in Addressing the Climate Change Risks

respondents even revealed that since it is hard to quantify or forecast the severity of the climate change impacts and the lack of standard measures regarding the performance indicators related to climate change risk management make it hard to confidently assess the level of preparedness regarding the management of climate change risks.

7. Test of significant difference on assessment of the extent of effects of climate change to the business when grouped according to the following profile variables.

respondents on the finance and accounting as area of the business affected by the climate change when they are grouped in according to form of business ownership as company profile. Lastly, since the computed F-value of 1.470 which yields a p-value of 0.224 which in turn is less than the critical value of 0.05, then there is no significant difference on the assessment of the respondents on the marketing of goods and services as area of the business affected by the climate change when they are grouped in according to form of business ownership as company profile.

Table.6: Significant Differences on the Extent of Effects of Climate Change to the Manufacturing Companies in Terms of Type of Product Manufactured

| Areas | F value | p-value | Decision |
|---------------------------------|---------|---------|-------------------|
| Production and Operations | 1.765 | 0.07 | Fail to Reject Ho |
| Finance and Accounting | 1.956 | 0.041 | Reject Ho |
| Marketing of Goods and Services | 2.107 | 0.026 | Reject Ho |

Table 6 shows that since the computed value of F which is 1.765, which in turn yields a p-value of 0.07, a value that is greater than the critical value of 0.05 which indicates that the null hypothesis could not be rejected. Thus, there is no significant difference on the assessment of the respondents when they are grouped according to the type of products manufactured as company profile. Furthermore, since the computed F-value which is 1.956 which in turn yield a p-value of 0.041 which is less than the critical value of 0.05, then the hypothesis is rejected, there is significant difference on the assessment of the respondent

in the financial and account as an area of the business affected by the climate change when they are grouped according to the type of product manufactured as company profile. Lastly, since the computed value of F, which is 2.107 which in turn yield a p-value of 0.026 which is also less than the critical value of 0.05, then the null hypothesis is rejected, there is significant difference on the assessment of the respondents on the marketing of goods and services as area of the business affected by the climate change when they are grouped according to the type of product as company profile variable.

7.3. Capitalization.

Table.7: Significant Differences on the Extent of Effects of Climate Change to the Manufacturing Companies in Terms of Capitalization

| Areas | F value | p-value | Decision |
|---------------------------|---------|---------|-------------------|
| Production and Operations | 1.562 | 0.200 | Fail to reject Ho |
| Finance and Accounting | 0.491 | 0.689 | Fail to reject Ho |
| Marketing | 0.405 | 0.749 | Fail to reject Ho |

The table shows that the computed F-value which is 1.562 that results to a p-value of 0.200 which is greater than the critical value of 0.05 then the null hypothesis cannot be rejected, and thus, there is no significant difference on the assessment of the respondents on the operations and production as an area of the business affected by the climate change when they are grouped according to capitalization. In addition, since the computed F-value of 0.491 which brings about a p-value of 0.689 that is greater than the critical value of 0.05, then the null hypothesis cannot be rejected, there is no significant

difference on the assessment of finance and accounting as an area of business affected by the climate change when the respondents are grouped according to capitalization as profile variable. Lastly, since the computed F-value of 0.405 which brings about a p-value of 0.749 that is greater than the critical value of 0.05, then the null hypothesis cannot be rejected, there is no significant difference on the assessment of marketing of goods and services as an area of business affected by the climate change when the respondents are grouped according to capitalization.

7.4. Number of Years in Operation.

Table.8: Significant Differences on the Extent of Effects of Climate Change to the Manufacturing Companies in Terms of Number of Years in Operation

| Areas | F value | p-value | Decision |
|---------------------------------|---------|---------|-------------------|
| Production and Operations | 0.590 | 0.622 | Fail to reject Ho |
| Finance and Accounting | 3.721 | 0.012 | Reject Ho |
| Marketing of Goods and Services | 2.413 | 0.068 | Fail to reject Ho |

Since the computed valued of F is 0.590 which results to a p-value of 0.622 which is greater than the critical value of 0.05, then the null hypothesis cannot be rejected. There is no significant difference on the assessment of the respondents on operation and production as an area of the business affected by the climate change when they are grouped according to number of years in operation as profile variable. Also, since the computed F-value is 3.721 which result to a p-value of 0.012 which is less than the critical value of 0.05, then the null hypothesis is rejected, there is significant difference on the assessment

of the respondents on the finance and accounting as an area of the business affected by the climate change when they are grouped according to the number of years in operation as profile variable. Lastly, since the computed valued of F is 2.41 which results to a p-value of 0.068 which is greater than the critical value of 0.05, then the null hypothesis cannot be rejected. There is no significant difference on the assessment of the respondents on marketing of goods and services as an area of the business affected by the climate change when they are grouped according to number of years in operation.

7.5. Number of Years Climate Risk Management Practices were adopted in the Company.

Table.9: Significant Differences on the Extent of Effects of Climate Change to the Manufacturing Companies in Terms of Number of Years Climate Risk Management Practices were Adopted

| Areas | F value | p-value | Decision |
|---------------------------------|---------|---------|-------------------|
| Production and Operations | 1.142 | 0.338 | Fail to reject Ho |
| Finance and Accounting | 0.977 | 0.422 | Fail to reject Ho |
| Marketing of Goods and Services | 1.883 | 0.115 | Fail to reject Ho |

Since the computed value of F which is 1.142 which results to a p-value of 0.338 is greater than the critical value of 0.05, then the null hypothesis cannot be rejected. Moreover, since the computed value of F which is 0.977 which results to a p-value of 0.422 is greater than the critical value of 0.05, then the null hypothesis cannot be rejected. Lastly, since the computed value of F which is 1.883 which results to a p-value of 0.115 is greater than the

critical value of 0.05, then the null hypothesis cannot be rejected.

8. Result of the test of significant difference on assessment of the effectiveness of climate change risk management practices of the companies when grouped according to the following profile variables.

8.1. Form of business.

Table.10: Significant Differences on the Assessment of the Effectiveness of Climate Change Risk Management Practices in Terms of Form of Business

| Areas | F value | p-value | Decision |
|-----------------------------|---------|---------|-------------------|
| Building Awareness | 5.507 | 0.001 | Reject Ho |
| Assessment of Vulnerability | 8.305 | 0.000 | Reject Ho |
| Managing the Risks | 1.628 | 0.184 | Fail to reject Ho |
| Review & Feedback | 1.843 | 0.141 | Fail to reject Ho |

It can be seen from the table that since the computed value of F which is 5.507 that results to a p-value of 0.01 which is less than the critical value of 0.05, then the hypothesis is rejected, there is significant difference on the assessment of the respondents on the building of awareness as part of the risk management practices related to climate change implemented by the manufacturing companies in Batangas province when they are group in accordance to form of business ownership. Also, since the computed

value of F which is 8.305 that results to a p-value of 0.000 which is less than the critical value of 0.05, then the hypothesis is rejected. On the other hand, since the computed value of F which is 1.628 that results to a p-value of 0.184 which is greater than the critical value of 0.05, then the hypothesis is cannot be rejected. Lastly, since the computed value of F which is 1.843 that results to a p-value of 0.141 which is greater than the critical value of 0.05, then the hypothesis is accepted.

8.2. Type of Products Manufactured.

Table.11: Significant Differences on the Assessment of the Effectiveness of Climate Change Risk Management Practices in Terms of Type of Product Manufactured

| Areas | F value | p-value | Decision |
|-----------------------------|---------|---------|-------------------|
| Building Awareness | 3.500 | 0.000 | Reject Ho |
| Assessment of Vulnerability | 3.272 | 0.001 | Reject Ho |
| Managing the Risks | 1.822 | 0.059 | Fail to reject Ho |
| Review and Feedback | 1.713 | 0.081 | Fail to reject Ho |

The table shows that since the computed value of F which is 3.500 which results to a p-value of 0.000 which is less than the critical value of 0.05, then the null hypothesis is rejected, there is significant difference on the assessment of the respondents on the building of awareness as part of the risk management practices related to climate change implemented by the manufacturing companies in the province of Batangas when they are grouped according to type of product manufactured as profile variable. Also, since the computed value of F which is 3.272 results to a p-value of 0.001 which is less than the critical value of 0.05, then the null hypothesis is rejected, there is significant

difference on the assessment of the respondents effectiveness of the climate risk management practices implemented by the manufacturing companies when they are grouped according to type of product manufactured. In addition, since the computed value of F which is 1.882 which results to a p-value of 0.059 which is greater than the critical value of 0.05, then the null hypothesis cannot be rejected. Finally, since the computed value of F which is 1.713 which results to a p-value of 0.081 which is greater than the critical value of 0.05, then the null hypothesis cannot be rejected.

8.3. Capitalization.

Table.12: Significant Differences on the Assessment of the Effectiveness of Climate Change Risk Management Practices in Terms of Capitalization

| Areas | F value | p-value | Decision |
|-----------------------------|---------|---------|-----------|
| Building Awareness | 7.197 | 0.000 | Reject Ho |
| Assessment of Vulnerability | 9.981 | 0.000 | Reject Ho |
| Managing the Risks | 4.052 | 0.008 | Reject Ho |
| Review & Feedback | 3.027 | 0.031 | Reject Ho |

It can be seen that since the computed value of F which is 7.197 which results to a p-value of 0.000 which is less than the critical value of 0.05, then the hypothesis is rejected, there is significant difference on the assessment of the effectiveness of the building of awareness as climate change risk management practices of the manufacturing companies when they are grouped according to capitalization. Also, since the computed value of F which is 9.981 which results to a p-value of 0.000 which is less than the critical value of 0.05, then the hypothesis is rejected, there is significant difference on the assessment of the effectiveness of the assessment of risks as climate change risk management practices of the manufacturing companies when they are grouped according to capitalization.

Moreover, since the computed value of F which is 4.052 which results to a p-value of 0.008 which is less than the critical value of 0.05, then the hypothesis is rejected, there is significant difference on the assessment of the effectiveness of the management of risks as climate change risk management practices of the manufacturing companies when they are grouped according to capitalization. Finally, since the computed value of F which is 3.027 which results to a p-value of 0.031 which is less than the critical value of 0.05, then the hypothesis is rejected, there is significant difference on the assessment of the effectiveness of the feedback criteria as climate change risk management practices of the manufacturing companies when they are grouped according to capitalization.

8.4. Number of Years in Operation.

Table.13: Significant Differences on the Assessment of the Effectiveness of Climate Change Risk Management Practices in Terms of Number of Years in Operation

| Areas | F value | p-value | Decision |
|------------------------------|---------|---------|-------------------|
| Building Awareness | 1.38 | 0.250 | Fail to reject Ho |
| Assessment of Vulnerability | 1.920 | 0.128 | Fail to reject Ho |
| Managing the Risks | 1.252 | 0.292 | Fail to reject Ho |
| Review and Feedback Criteria | 2.32 | 0.077 | Fail to reject Ho |

The data shows that since the computed value of F which is 1.38 which results to a p-value of 0.250 which is greater than the critical value of 0.05, there is no significant difference on the assessment of the effectiveness of the building of awareness as climate change risk management practices of the manufacturing companies when they are grouped according to number of years of operation. In addition, since the computed value of F which is 1.920 which results to a p-value of 0.128 which is greater than the critical value of 0.05, then there is no significant difference on the assessment of the effectiveness of the assessment of risks as climate change risk management practices of the manufacturing companies when they are grouped according to years of operations. More so, since the computed value

of F which is 1.252 which results to a p-value of 0.292 which is greater than the critical value of 0.05, then there is no significant difference on the assessment of the effectiveness of the management of risks as climate change risk management practices of the manufacturing companies when they are grouped according to number of years of operation. Lastly, since the computed value of F which is 2.32 which results to a p-value of 0.077 which is greater than the critical value of 0.05, then there is no significant difference on the assessment of the effectiveness of the feedback criteria as climate change risk management practices of the manufacturing companies when they are grouped according to number of years in operation.

8.5. Number of Years Climate Risk Management Practices were adopted in the Company.

Table.14: Significant Differences on the Assessment of the Effectiveness of Climate Change Risk Management Practices in Terms of Number of Years Climate Risk Management Practices were Adopted in the Company

| Areas | F value | p-value | Decision |
|-----------------------------|---------|---------|-----------|
| Building Awareness | 3.602 | 0.007 | Reject Ho |
| Assessment of Vulnerability | 4.224 | 0.003 | Reject Ho |
| Managing the Risks | 3.461 | 0.009 | Reject Ho |
| Review and Feedback | 3.787 | 0.006 | Reject Ho |

The data on the table shows that the computed value of F which is 3.602, that resulted to a p-value of 0.007 which is less than the critical value of 0.05, then the

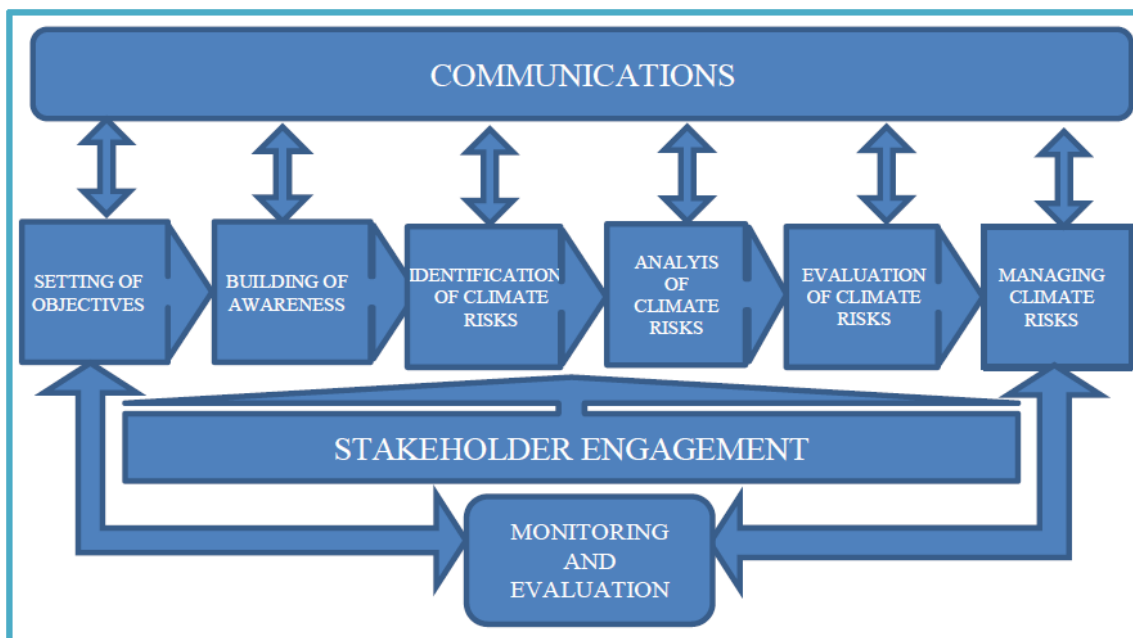
hypothesis is rejected, there is significant difference on the assessment of the respondents regarding the effectiveness building of awareness as part of the climate change risk

management practices of the manufacturing firms when they are grouped according to number of years climate risk management practices is adopted or observed in the company. In addition since the computed value of F which is 4.224 which yields a p-value of 0.003 that is less than the critical value of 0.05, then the hypothesis is rejected, there is significant difference on the assessment of the respondents on the level of effectiveness of the building of awareness as part of the climate change risk management practices of the manufacturing companies when they are grouped according to the number of years climate risk management practices is adopted or observed in the company. More so, since the computed value of F which is 3.461 which results to a p-value of 0.009 which is less than the critical value of 0.05, then the hypothesis could not be rejected, there is no significant difference on the assessment of the effectiveness of the management of risks as climate change risk management practices of the manufacturing companies when they are grouped according to number of

years climate change risk management practices is adopted or observed in the company. Lastly, since the computed value of F which is 3.787 which results to a p-value of 0.006 which is less than the critical value of 0.05, then the hypothesis could not be rejected, there is no significant difference on the assessment of the effectiveness of the feedback criteria as climate change risk management practices of the manufacturing companies when they are grouped according to number of years in operation.

9. Proposed Guidelines for Implementation of Climate Risk Management Practices

This guidelines is an output of the study “Extent of Effects and Practices on Climate Risk Management of Manufacturing Firms in the Province of Batangas”. The guidelines is structured in accordance to the findings of the study. The figure below indicates the summary of the guidelines that will be discussed below:



Objectives:

The guidelines for implementation endeavors to propose a simple guide for implementation of climate risk management practices that the manufacturing firms could adopt in order to improve their resiliency in the face of climate change risk thereby enhancing their actions on the climate risk management that could benefit their companies in the long run.

Guidelines

The following are the steps for in implementing climate risk management:

1. Setting of Objectives

- Establish definitive scope of the actions on climate risk management in the organization
- Formulate clear cut objectives and integrate such objectives to the company policy and strategic plan in consideration of Company's Mission and Vision
- Identify the stakeholders and their level of involvement

- Establish criteria for measurement on the climate risk management effort
- ##### 2. Building of Awareness
- Conduct assessment on the level of awareness/knowledge of the stakeholder of the organization regarding climate change risk management
 - Formulate action plan for increasing the level of awareness of every stakeholder in the organization regarding the climate risk related management, general concepts and the tools and techniques in assessment and in management of risks
 - Implement the action plan, focusing on the enhancement of knowledge of every stakeholder of the organization regarding the climate change and the risks it represents
 - Monitor and evaluate the progress of the stakeholders
- ##### 3. Identification of climate risks

- Identify and define all risk that affect the business operations in all areas
 - Enumerate all the identified risk on each areas of the business operation
4. Analysis of Climate Risks
- Review the strategies and practices to mitigate the identified risk
 - Choose the assessment, criteria, tools and techniques to be used in the proper analysis of the identified risks
 - Assess the identified risks in consideration of the formulated goals and criteria
5. Evaluation of the Climate Risks
- Rank the identified risks brought about by the climate change in accordance to the level of importance and its impact to the organization;
 - Ascertain the level of priority of the identified risks focusing on the most important and most severe and identify risks that needs more detailed analysis
6. Managing of the Climate Risk
- Formulate solutions/options to manage or adapt the identified risks
 - Select the best options/solutions that could be used in managing the risks
 - Integrate the selected options and solutions and assign resources to ensure proper implementation
 - Implement the best options and solutions to manage the identified risks

Communication

Communication is a key component for every risk management endeavor and should be present in all steps of the risk management process. The creative inputs of everybody in the organization is important in the achievement of success in all areas of the climate risk management initiatives that the organization may implement. It is imperative that all that are involved in the climate management initiatives are well informed on all areas from planning, to development, to implementation, to monitoring and evaluation and also revision and changes that may happen as the initiative push thru. Thus, the following should be observed in the organization.

- The organization should endeavor to promote free flow of information regarding the climate risk management in climate risk management actions.
- All employees of the organization should be knowledgeable of the actions done by the organization regarding climate risk management activity.
- Consultative decision making is encouraged to involve everybody in the climate change risk management actions in terms of communication.

Engagement of the Stakeholders

In order to increase the chance of success of climate risk management actions, the engagement of the firm's stake holder is essential. There are two type of

stakeholders (1) Internal Stakeholder which may be composed of owners, top management, middle management, supervisor, employees and (2) External Stakeholder which may be composed of government, community, suppliers, market, and competitors.

The engagement of the firm's internal and external is an important boost to the efforts in climate risk management process. Involving the stakeholders of the organization could provide leverage in managing risks brought about by the climate change. The following may be of help.

- Creation of sustainable partnership with the government agencies to improve enactment, and implementation of the laws and legislation regarding the climate risk management
- Creation of sustainable partnerships with the community to enhance community support in climate risk management endeavors.
- Creation of sustainable partnership with academic institutions to boost capability in acquiring and disseminating knowledge particularly in the area of research and trainings.
- Creation of sustainable partnership with the Non-governmental institutions that advocate climate change initiatives to further boost knowledge and capability of the organizations.
- Creation of sustainable partnership with suppliers and distributors to ensure alignment supply chain practices to the climate risk management action that will be adopted by the organization.

Monitoring and Evaluation

The monitoring and evaluation of each of the steps in the climate risk management is very important to the success of climate risk management actions. All outputs of the climate change risk management adaptation and initiatives should be reviewed in consideration with the formulated criteria and objectives. It is also important that the climate risk management initiatives/actions be monitored and evaluated so as to be updated and responsive to the ever changing dynamics of the business and physical environment. This will enable adjustments if necessary to ensure efficient and effective implementation of the climate risk management initiatives: The following should be observed in monitoring and evaluation of climate risk management activities.

- Planned and regular monitoring and evaluation of the climate risk management activity.
- Analysis and evaluation of should be updated, including climate risk management scenarios, information about climate change risks impacts, changes in vulnerability assessments, and level of effectiveness of the implementation of existing climate risk management practices.
- Complete and comprehensive documentation and paperwork should be done in the monitoring and evaluation process, this would enable the concerned personnel/employees to

use the documents for strategic assessment and if so, re-planning of climate risk management initiatives and actions for continuous improvement process.

V. CONCLUSIONS

After analysing and interpreting the data gathered, the following conclusions were drawn:

1. Climate change has a moderate effect on the manufacturing companies in terms of production and operations, finance and accounting, and marketing.
2. The manufacturing firm perceived typhoon to have a high risk when it comes to the physical impact of climate change that are encountered by the manufacturing firms.
3. The climate risk management practices of the manufacturing firms were moderately effective in the area of building awareness, assessment of risks, and in the area of review and feedback criteria. However, it is assessed as effective on the area of managing risks.
4. The manufacturing firms perceived that lack of strong regulation is a factor that have a very strong effect on the implementation of the climate risk management practices
5. The respondents from the manufacturing firms perceived that they "somewhat prepared" which is indicative that there is some uncertainty on their part on the real status in terms of managing the current and the future impacts of climate change
6. In terms of the significant differences of the effects of climate change, the null hypothesis is accepted in the area of production and operation in relation to form of business, capitalization, years in operation and number of years climate risk management were adopted. In the area of finance and accounting, the null hypothesis is accepted in relation to form of business, capitalization, years of operation, and number of years climate change risk management practices were adopted. Finally, in the area of marketing, the null hypothesis is accepted in relation to form of business, capitalization, years in operation, and number of years climate risk management practices were adopted.
7. There are significant differences on the assessment of the respondents on the effectiveness of climate risk management practices of the manufacturing firms in the area of building awareness when they are grouped according to form of business, type of product manufactured, capitalization and number of years climate change risk management practices were adopted or observed as profile variables.
8. There are significant difference on the assessment of the respondents on the effectiveness of climate risk management practices of the manufacturing firms in the area of managing risks when they are grouped according to capitalization, and number of years climate risk management practices has been observed or adopted as profile variables.
9. Finally, there are significant differences on the assessment of the respondents on the effectiveness of climate risk management practices of the

manufacturing firms in the area of review and feedback criteria when they are grouped according to capitalization, and number of years climate risk management practices have been adopted or observed.

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